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OBTAINING FORMALDEHYDE RESINS FROM MEA

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A B S T R A C T

With the growth of global production, the scope of application of their products is expanding. In this regard, new requirements are being imposed on their quality and waste recycling. At present, the chemical industry has a number of organic waste products that can replace synthetic polymers. After processing this waste, it becomes an adhesive binder with good adhesive properties. Of course, the polymer forms the basis of the glue and the choice of polymer is the first and decisive step in creating the glue. When choosing an adhesive polymer, it is necessary to take into account not only its chemical nature, concept and mutual arrangement of functional groups, but also the molecular weight distribution of poly dispersion and other features of the chemical structure. The use of polymers with a narrow molecular weight distribution ensures the production of adhesives with stable properties.

K E Y W O R D S

formaldehyde resin, cubic residue of MEA, polarographic method.

Synthetic adhesives glue any materials together, forming high-strength, durable joints that can work in a wide temperature range and in any climatic conditions. An important property of compounds based on synthetic adhesives is their weather resistance, the ability to resist corrosion and rotting. In some cases, adhesive joints ensure the tightness of structures.

Introduction

In some cases, adhesive structures must provide strength with uneven separation of up to 50-80 kgf/cm ^{2} . Adhesive joints of non-metallic materials must have a strength close to the strength of the materials being glued [1,2]. Considering the connection between the chemical structure and structure of polymers and their adhesive properties, one is convinced of the confirmation of the influence of the nature of functional groups on the adhesive and cohesive properties of monomer and polymer compounds. Of course, polymer forms the basis of the adhesive and the choice of polymer is the first and decisive step in creating the adhesive. When choosing an adhesive polymer, it is necessary to take into account not only its chemical nature, concept and relative arrangement of functional groups, but also molecular mass distribution, polydispersity and other features of the chemical structure. The use of polymers with a narrow molecular weight distribution ensures the production of adhesives with stable properties [2]. In addition to the polymer, the adhesive composition includes fillers, stabilizers, plasticizers, thickeners and other components. The chemical industry has a number of organic wastes that can replace synthetic glues. For example, condensation of aqueous solutions of Na -salt of carboxylmethylcellulose , acetone solution of cellulose diacetate , liquid bottoms of

monoethanolamine , bottoms of acetic acid regeneration and others with formaldehyde.[3-6]. We studied the process of producing resins based on formaldehyde and the bottoms of ammonia production - monoethanolamine (MEA). Nitrogen enterprises have a number of ways to dispose of this waste, one of which is burning the latter, which leads to environmental poisoning. During the work, the influence of such catalysts as sodium hydroxide, ammonium chloride, ammonium nitrate, ammonia, oxalic and sulfuric acids on the process of producing MEA - formaldehyde resin was studied. Among the catalysts studied, oxalic and sulfuric acids turned out to be more active. The catalyst consumption was 6.01% of the main raw material. The effect of temperature on the viscosity of the resulting resin was also studied in the temperature range from 40°C to 200°C (Fig. 1). The graph shows that at a temperature of 40-60°C the viscosity of the resulting products is low and there are no binding properties. At a temperature of 80-100°C, the viscosity of the product increases, which leads to the appearance of weak binding properties. Above this temperature, the product became tarred, due to the rapid removal of itching from the reaction mixture. The product lost its soluble properties, which indicated a transition in the structure of the substance from linear to network. The timing of the process plays an important role in the production of polycondensation resins. And therefore we studied the effect of process time on product yield. As a result of the experiments, a graph was drawn up (Fig. 2).

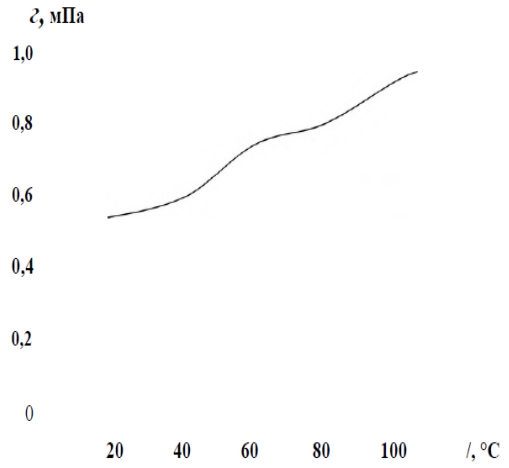
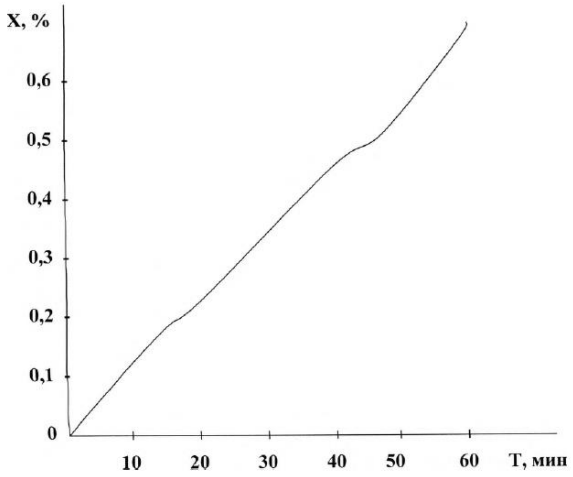


Figure 1. Effect of process temperature on product viscosity.



Rice. 2 The influence of process time on product yield.

The graph shows that the product yield has a maximum value from 60 to 90 minutes. The effect of the ratios of the reactants MEA and formaldehyde (1:1, 2:1, 3:1) at a temperature of 80-100 °C was also studied. Fluctuations in the MEA content in the bottom residue in a wide range from 31 to 52% did not make it possible to identify the influence of the ratio of reagents. The MEA content in the bottom residue and reaction products was determined by the polarographic method, according to a pre-compiled curve, and the formaldehyde content by the sulfite method. Experiments have shown that formaldehyde consumption does not exceed 60%; the optimal conditions for the above process parameters could not be determined. The quality of the resulting resin was controlled by viscosity, which was determined using a VZ-262 viscometer. It increased with increasing process time, and decreased with increasing temperature. The binding properties of the resulting resin were determined

according to GOST 11368-89 “Wood pressing compounds”. The standard applies to wood compacts obtained by the combined processing of wood particles, synthetic resins or their modification (45). The samples for testing under compression had dimensions of (30+0.5)x (15+0.5)x(10+0.5) mm and under static bending had dimensions of (160+2)x(15+0.2) x(8+0.5) mm. Pressing conditions: temperature 130°C, pressure 30 MPa, holding time 10 minutes. The test results showed that the compressive strength is 1.06 kgf/cm ^{2}, shear 0.973 kgf/cm ^{2} (average of three tests). It can be seen that MEA-formaldehyde resin in the modes carried out did not have sufficient binding properties. This was facilitated by the presence of water in both types of raw materials. The first stage of the reaction, the condensation of MEA with formaldehyde, proceeds normally, as evidenced by the increase in temperature from room temperature to 60-61°C. The second stage of the reaction is the interaction of elementary units with the release of water, i.e. The polycondensation reaction occurs slowly. In addition, the resulting molecules dissolve well in water due to the existing OH groups. This leads to the exclusion of the adhesive properties of the resulting resins. In addition, part of the formaldehyde remained in the mixture in an unbound form.

The solution to this problem was to replace part of the urea (20-30%) when producing urea-formaldehyde resin with the bottoms of MEA. As a result, a product will be obtained consisting of two polymers (urea-formaldehyde and MEA formaldehyde) that modify each other. The influence of catalysts, process temperature, process time, ratio of reactants, etc. on the process of producing urea - MEA - formaldehyde resin was studied. The test results showed that the resin obtained by the above method has good adhesive and adhesive properties compared to the urea -formaldehyde resin itself. For example, the shear strength is 2.3 kgf/cm ^{2}, versus 1.9 kgf/cm ^{2}; at compression 1.7 kgf/cm ^{2}, versus 1.3 kgf/cm^2

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